	Water discharged per second.	Sediment per annum.	Subaërial denudation.
	Cubic feet.[1]	Cubic feet.	
Amazon	2,458,026	—	—
Congo	1,800,000 (By Belun and Capt. Tuckey)	—	—
Yang-tse	770,397 (By myself)	6,428,800,000 (By myself)	1 foot in 3,707 years. (By myself)
Plate	700,000 (By Mr. Higgin and Mr. Bateman)	1,543,500,000 (By Mr. Higgin)	1 foot in 29,400 years. (Calculated from Mr. Higgin's estimate)
Mississippi ...	618,000 (By Messrs. Humphreys and Abbot)	7,474,000,000 (By Messrs. Humphreys and Abbot)	1 foot in 6,000 years. (By Mr. Croll)
Danube	300,321	1,255,500,000 (By Mr. Ch. Hartley)	1 foot in 6,846 years.
Shat-el-Arab ...	295,461	—	—
Ganges, at Ghazepoor ...	203,485 (By the Rev. Mr. Everest)	6,368,000,000 (By the Rev. Mr. Everest)	1 foot in 2,358 years.
Indus	199,476	—	—
Atrato	185,274	—	—
Nile	130,032	—	—
Yellow River ...	116,000 (By Sir George Staunton)	17,520,000,000 (By Sir George Staunton)	1 foot in 1,464 years.
Rhone	91,935	594,000,000	1 foot in 1,528 years.
Rhine	69,741	—	—
Po	61,263	405,420,000 (By M. Lombardini)	1 foot in 729 years.
Pei-ho	7,755 (By myself)	80,000,000 (By myself)	1 foot in 25,218 years.
Thames, at Kingston ...	2,300 (By Prof. Prestwich)	1,865,900 (Huxley's "Physiography.")	1 foot in 9,600 years.[2] (Huxley's "Physiography.")

We have now the necessary "data" for considering these three rivers in their conjoint character. Together they drain an area of 1,105,000 square miles; they discharge a body of water equal to *894,000 cubic feet every second;* and they carry down every year to the sea *24,028,800,000*[3] *cubic feet of sediment,* which represents a rate of subaërial denudation equal to the removal of *one foot of solid rock in 1,687 years.*

If we look upon the Yang-tse, the Yellow River, and the Pei-ho as labouring, with the assistance of the gradual elevation of the sea-border which is at present going on, to extend the territory of China seaward towards her ancient coast-line—represented by a line running from Kamtschatka through the Kurile Islands, Japan, the Loo-choo group, Formosa down to the Malay Archipelago;[4] and carry ourselves forward into the future when such task is completed and the waves of the Pacific beat once more against this old sea-border, we shall not have much difficulty in picturing to ourselves what will then be the state of matters. In the place of the gulf of Pe-chili and the Yellow Sea there will be vast alluvial plains traversed by the waters of the Yang-tse, the Yellow River, and the Pei-ho; but before the ancient coast-line is reached they will have joined to form one great river and one united delta. If the Yellow River confines itself mostly in future ages to its course into the gulf of Pe-chili, that gulf will be filled up in process of time; and the Hoang-ho winding along through the bed of this obliterated sea will, after being joined by the Pei-ho, turn its course southward, deflected by the Corean peninsula, until it meets at length its sister stream. On the other hand, should the Yellow River be mostly occupied in future in advancing its southern delta it will join the Yang-tse at a period much less remote from the present; and their united waters will pursue an easterly direction subsequently to be joined by the Pei-ho, which will have been gradually finding its way through the gulf of Pe-chili and the Yellow Sea during the preceding ages. In either event the union of these three rivers would follow.

Such being the case, it may be interesting to speculate on the time required by these rivers to fill up the seas into which they discharge their sediment. Sir George Staunton estimated that at the rate the Hoang-ho was discharging sediment it would fill up the Yellow Sea and the gulfs of Pe-chili and Lian Tung in 24,000 years; but M. Elisée Reclus is of opinion that this estimate ought to be doubled, as the Yellow Sea is much deeper than Sir George Staunton stated it to be (20 fathoms). On carefully examining the latest charts of these seas I am inclined to consider that this estimate cannot be assailed on this point, as my own determination of the average depth is 22 fathoms.

We will now attempt to gauge the time that the three rivers in question would require to fill up by the sediment they deposit the portion of sea which is included by the gulfs of Pe-chili and Lian Tung, the Yellow Sea, and the Eastern Sea north of the 29th parallel and west of the 126th meridian. I have placed the total surface area at 200,000 English square miles, and the average depth at 26 fathoms; and following Sir George Staunton's mode of estimation I find that it would take sixty-six days to form an island a mile square reaching up to the surface of the sea. At this rate it would require 36,000 years to form all the sea in question into dry land, supposing of course that there was no elevation or depression of the sea-bottom during that period. But, the recent formation of several islands and shoals in the Yang-tse estuary, the occurrence of raised beaches and marine remains at Hang-chau, Wusung, and Chefoo, with other similar evidences, demonstrate that there is an elevation of the coast going on at present; and, in that case, it will require considerably less than 36,000 years to form the sea into *terra firma.* Perhaps Sir George Staunton's original estimate for the Yellow River may not be far wrong when applied to the whole sea in question.

PHYSICS WITHOUT APPARATUS[1]

VI.

ACOUSTICAL experiments require, for the most part, the aid of some good instrument or valuable piece of apparatus. Nevertheless a few instructive illustrations of the principles of the science can be improvised without difficulty. Firstly, there is the familiar experiment brought into fashion, we believe, by Prof. Tyndall, of setting a row of ivory billiard balls or glass solitaire marbles along a groove between two wooden boards, and showing how their elasticity enables them to transmit from one to another a wave of moving energy imparted to the first of the row, thus affording a type of the transmission of sound-waves from particle to particle through elastic media. Then we may show how sounds travel through solid bodies by resting against a music-box or other musical instrument, a broomstick, or any convenient rod of wood, at the other end of which we place our ear. A kindred experiment, illustrative of the transmission of sounds through threads, is depicted in Fig. 20. A large spoon is tied to the middle of a thin silken or hempen thread, the ends of which are thrust into the ears upon the ends of the thumbs. If the spoon be dangled against the edge of the table it will resound, and the tones reach the ear like a loud church bell. The thread telephone or "lover's telegraph," is upon the same principle, the thread transmitting the whispered words to a distance, without that loss by spreading in all directions which takes place in the open air.

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[1] Where not otherwise mentioned I have obtained my information of the discharge of water and sediment from the "Earth," by Elisée Reclus.

[2] This estimate also includes the solids held in solution.

[3] In Page's "Advanced Text-book of Geology" Staunton's estimate of the sediment discharged by the Yellow River has been erroneously applied to all "the great Chinese rivers."

[4] *Vide* a paper on this subject, by Mr. A. S. Bickmore, read before the North China branch of the Asiatic Society in November, 1867.

[1] Continued from p. 464.

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The discovery that a musical tone is the result of regularly recurring vibrations, the number of which determines the pitch of the tone, was made by Galileo without any more formal apparatus than a mill-edged coin, along the rim of which he drew his thumb-nail, and found it to produce a sound. We can show this better by taking a common toy gyroscope-top with a heavy leaden wheel, such as are sold at every toy-shop. With a strong penknife or a file, cut a series of fine notches or grooves across the rim, so that it shall have a milled edge like a coin. Now spin it, and while it spins, gently hold against the revolving wheel the edge of a sheet of stiff writing-paper or of a very thin visiting card. A loud clear note will be heard if the nicks have been evenly cut, which, beginning with a shrill pitch, will gradually fall with a dolorous cadence into the bass end of the scale, and finally die out in separately audible ticks.

Much notice was attracted some years ago by the discovery of singing and sensitive flames. A sensitive flame is not easily made, unless where gas can be burned at a much higher pressure than is to be found in the case of the gas supplied by the companies for house-lighting. To make a singing-flame requires the proper glass tubes and an apparatus for generating hydrogen gas. The roaring-tube, which we are now about to describe, is a good substitute, however, and is also due to the generation of very rapid vibrations, although in this case the way in which the heat sets up the vibrations cannot be very simply explained. Let a common paraffin-lamp chimney be chosen, and let us thrust up loosely into its wider or bulbous portion a piece of iron-wire gauze such as is often employed for window-blinds. If this be not at hand a few scraps of wire twisted together, or even a few hair-pins will suffice. The lamp-chimney must then be held over the flame of a spirit-lamp, or other hot flame, until the wire-gauze glows with a red heat (see Fig. 21). Now remove the lamp or lift the chimney off it, so that the gauze may cool. It will emit a loud note like a powerful (though rather harsh) organ-pipe, lasting for about a quarter of a minute, or until the gauze has cooled. Tubes of different sizes produce different notes.

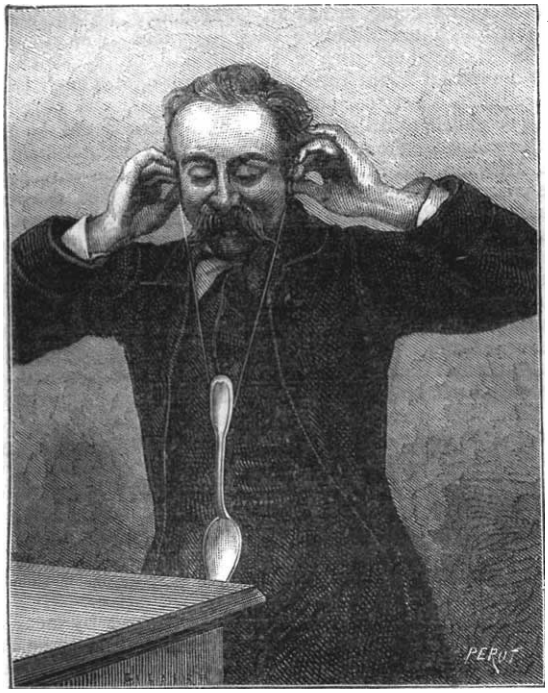

Fig. 20.

It is now well known that the quality of different sounds depends upon the form or character of the invisible sound-waves, and that different instruments make sounds that have characters of their own, because their peculiar shapes throw the air into waves of particular kinds. The different vowel-sounds are caused by putting the mouth into particular shapes in order to produce waves of a particular quality. Take a jew's-harp and put it to the mouth as if you were going to play it. Shape the mouth as if you were going to say the vowel O, and on striking the harp you hear that sound. Alter the shape of the mouth to say A, and the harp sounds the vowel accordingly. The special forms of vibration corresponding to the different vowel-sounds can be rendered evident to the eye in a very beautiful way by the simplest conceivable means. A saucerful of soapy water (prepared from yellow kitchen soap and soft water, or with cold water that has previously been boiled) and a brass curtain-ring, is all that is needed. A film of soapy water shows, as all children know when they blow bubbles, the loveliest rainbow-tints when thin enough. A flat film can be made by dipping a brass curtain-ring into the soapy water, and then lifting it out. When the colours have begun to show on the edge of the film, sing any of the vowels, or the whole of them one after the other, near the film. It will be thrown into beautiful rippling patterns of colour which differ with the different sounds. Instead of a curtain-ring the ring made by closing together the tips of finger and thumb will answer the purpose of providing a frame on which to produce the phoneidoscopic film.

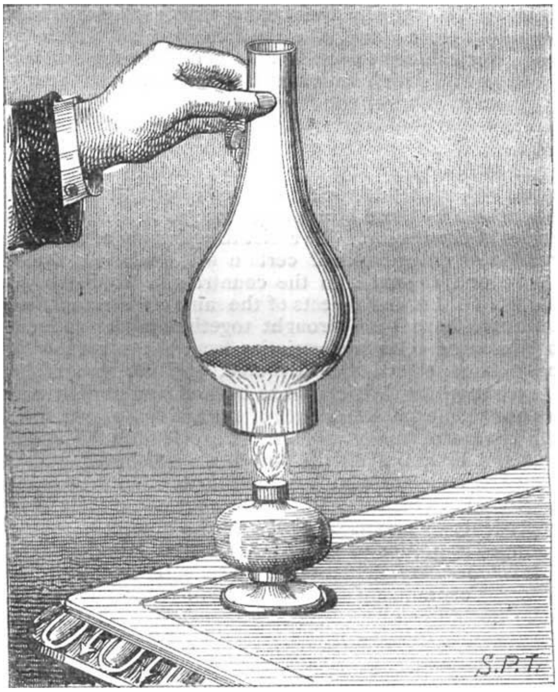

Fig. 21.

(*To be continued.*)

GENERAL PITT RIVERS' (LANE FOX) ANTHROPOLOGICAL COLLECTION

THE collection which General Pitt Rivers, F.R.S., commenced to form in the year 1851 became well known to all immediately interested in the science of

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